Ground-Based
Remote Sensing of GeoSpace

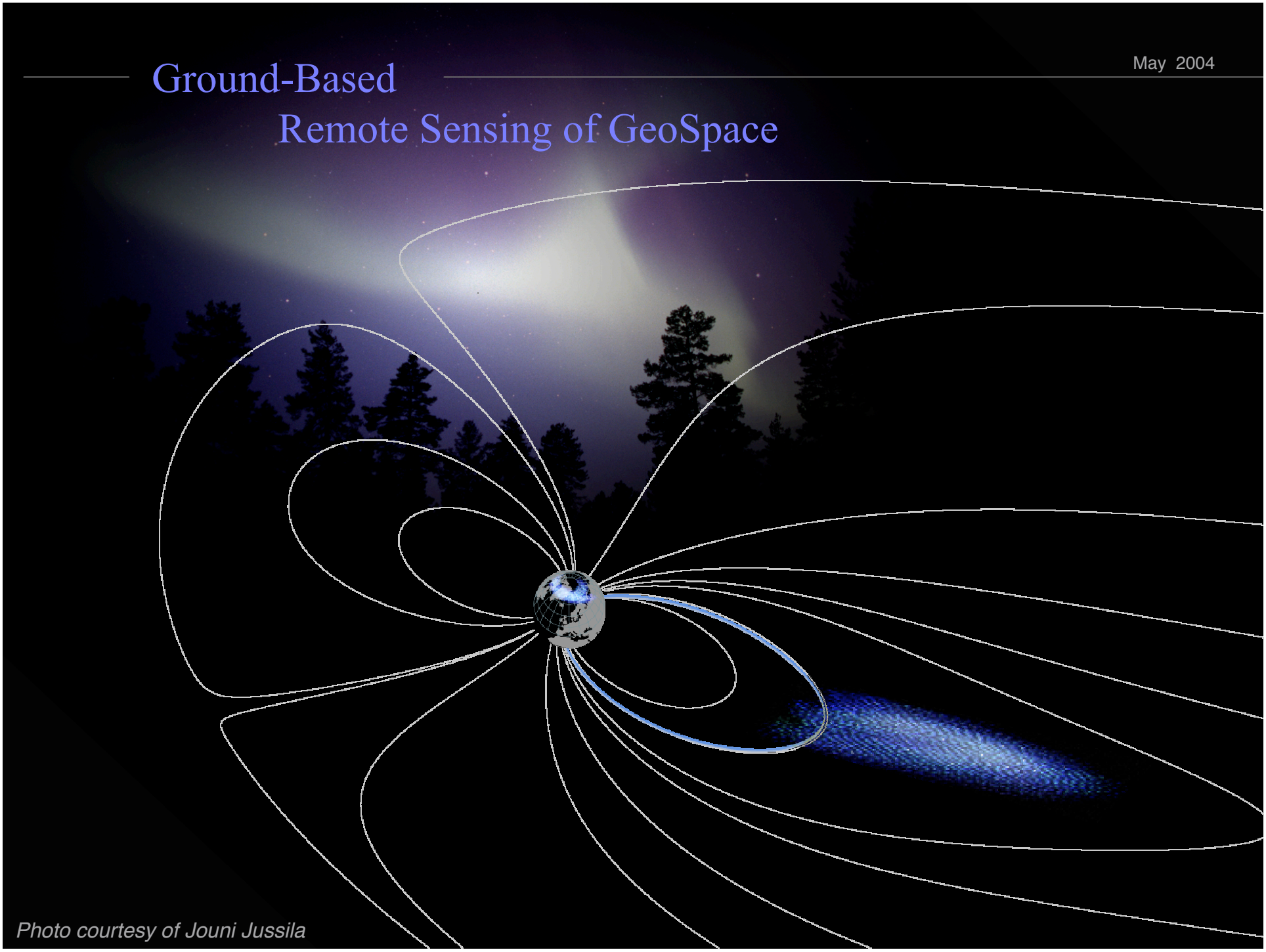
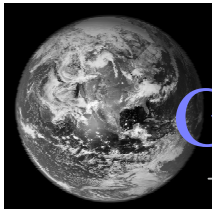


Photo courtesy of Jouni Jussila



GBTG Mandate

The overarching objective is to explore how solar variability affects the Earth environment in the short and long term. ILWS will explore microphysical processes in the sun-Earth system, focusing on those with planetary-scale effects and will quantify the geoefficiency of coupling processes.

1. A current inventory of relevant ground-based scientific instruments.
2. The scientific data generated by these instruments.
3. Upgrades, new instruments, arrays, programs, & missions proposed for the next 10 years.
4. Scenarios for coordination of instruments that maximize scientific impact worldwide.
5. Strategy for planning new initiatives, to maximize scientific impact & synergy.

ILWS Science

May 2004

Theme Defined – Need to Establish Targets

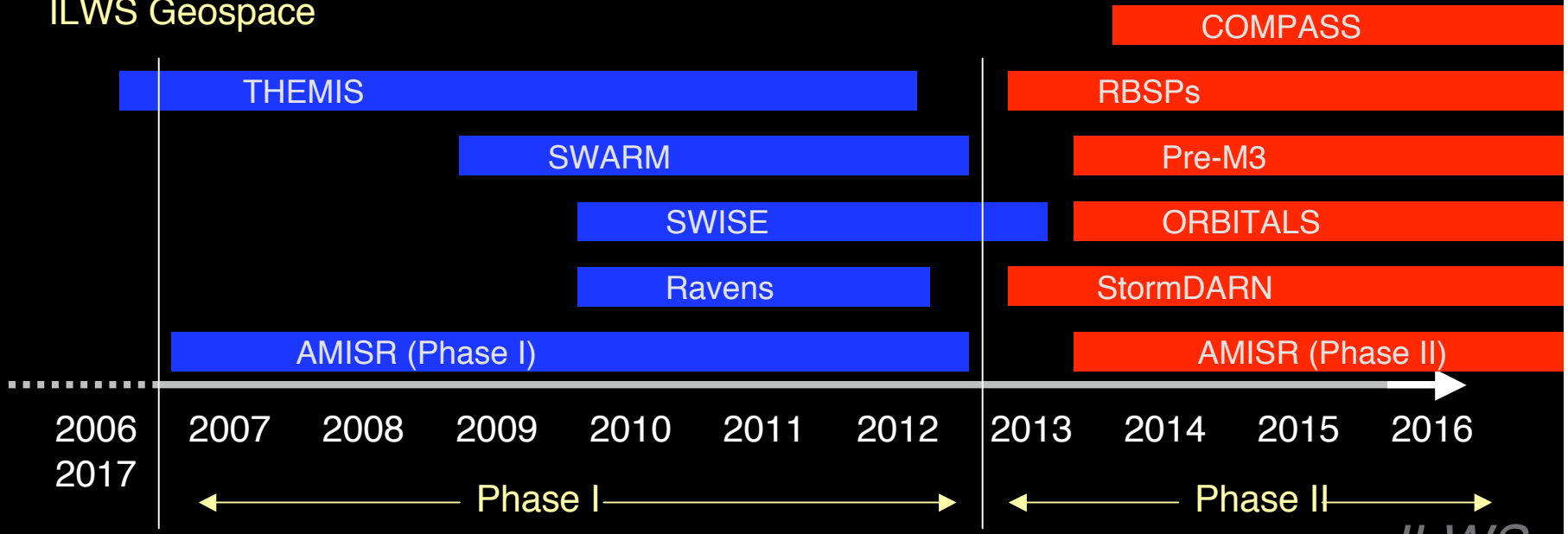
Science Theme (Systems Approach)…

The magnetosphere as transfer function between a driver and sinks. The transfer function represents large scale (bulk as in convection, BBFs, SIs, KH, Interchange, etc) and small scale (as in reconnection, scattering, wave-particle, etc) processes.

Demands continuous monitoring of the driver (solar wind) and the sinks (the ionosphere, thermosphere, ring current, radiation belts, and plasmashere).

Demands *in situ* observation of microscale (*Cluster, MMS, M3, FAST, NPOES, ISR, SWARM, etc…*) and remote sensing of the consequences of those processes as seen in the sinks (*GB, TIMED, SWARM, Ravens, RBSPs/ORBITALS, TWINS, GEC, LANL/MPA, LANL/SOPA, NPOES, GOES, etc...*).

ILWS Geospace



ILWS

Cross-scale Coupling

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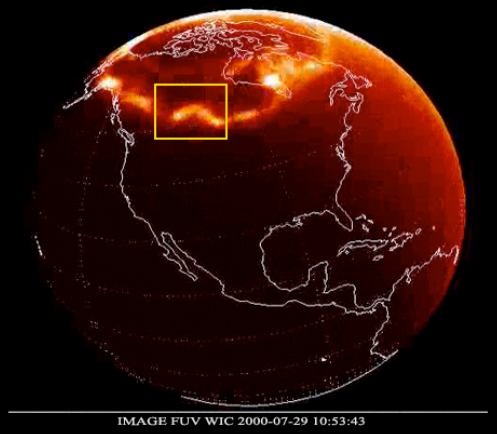

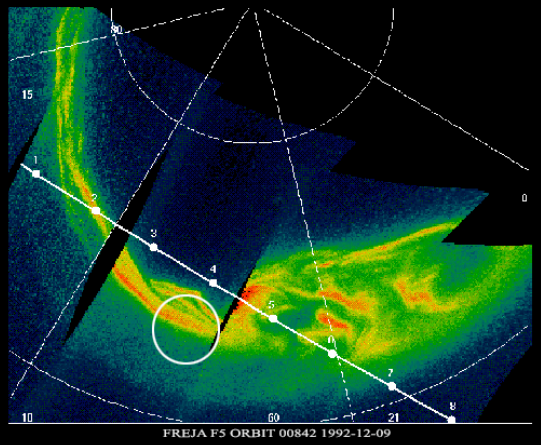

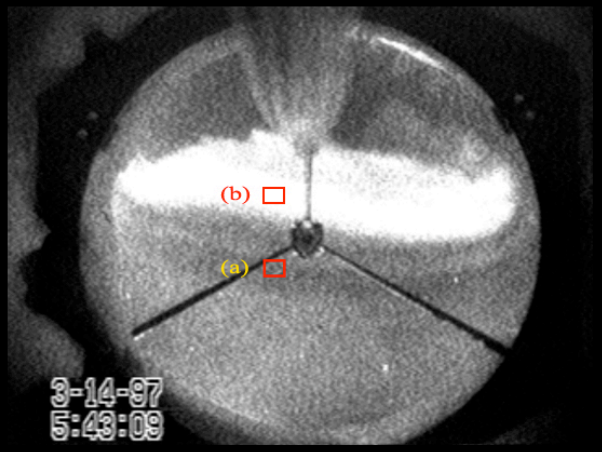

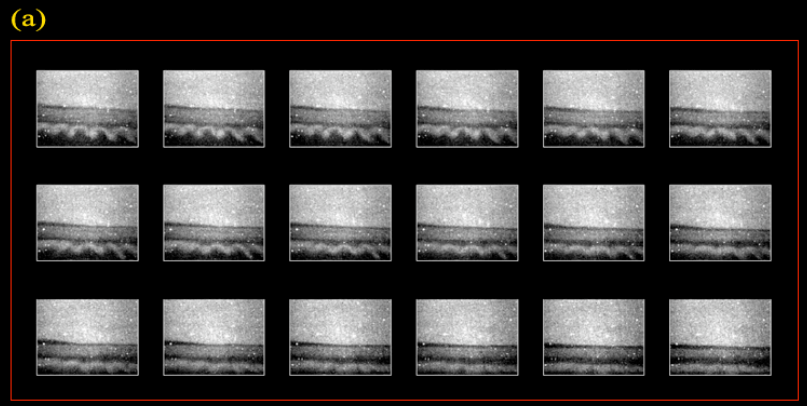

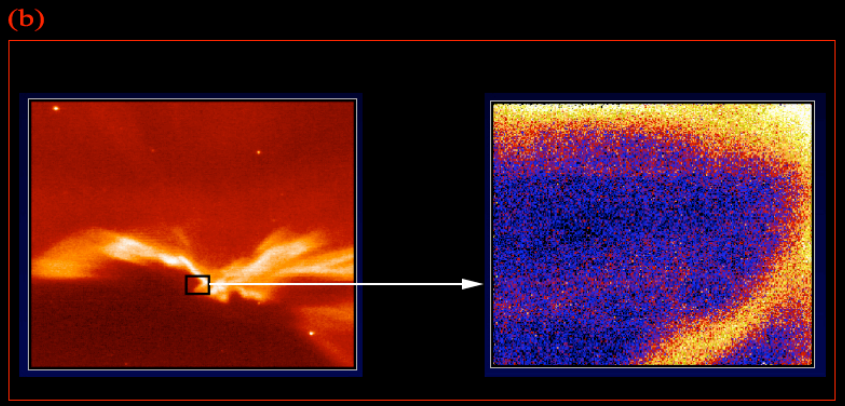

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ILWS Science

Theme Defined – Need to Establish Targets

Science Theme…

"Systems approach"

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How is GB essential in view of this theme?

GB can address *all time and space scales*

GB is ideal for studying *planetary scale* consequences of microphysical processes

GB is *truly global*, *truly integrated,* and is the *most international* element of geospace studies

GB *complements* key missions (complement is an understatement, actually)

GB *is the primary driver of data assimilation, space weather, grid technology, models of MI coupling, etc…*

GB During ILWS

What are the main thrusts on the world scene?

There are 5 thrusts on the world ground-based scene:

1) Large distributed arrays of inexpensive instruments (ie., THEMIS, DASI, CGSM, MIRACLE, SuperDARN, MERIDIAN, etc…)
2) Virtual arrays (ie., SuperDARN, SuperMag, GAIA, GLORIA, etc…)
3) Thematic Programs (ie., Europlanet, CAWSES, Intermagnet, MIRACLE, Natural Complexity, etc…)
4) Data assimilation (ie., AMIE, UMich ITR, CGSM FDAM, CCMC, etc…)
5) Large targeted facilities (ie., AMISR, SPEAR, EISCAT, Sondrestrom, PFRR, etc…)

Real Time Data Collection (via WWW – NEVER obsolete)

Open Data Policies – THE models is CDAWeb (NO questions asked access)

Common Data Formats – THE model is CDF (NO obstacles)

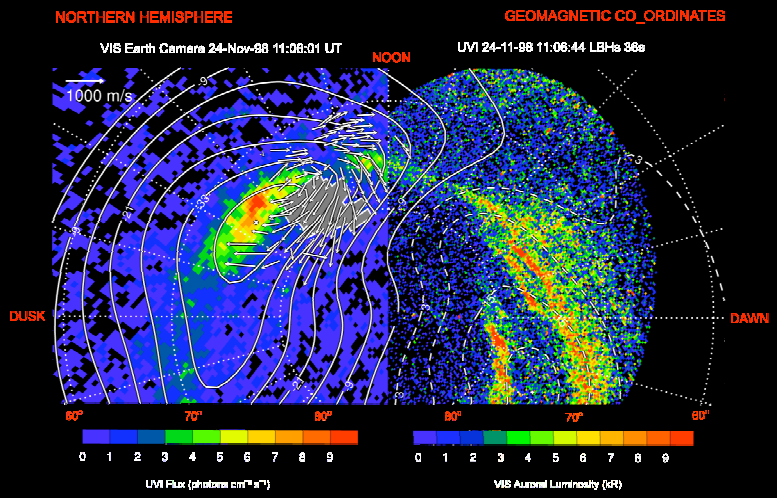
Meta-data, Attributes, Summary data – consider the user!!

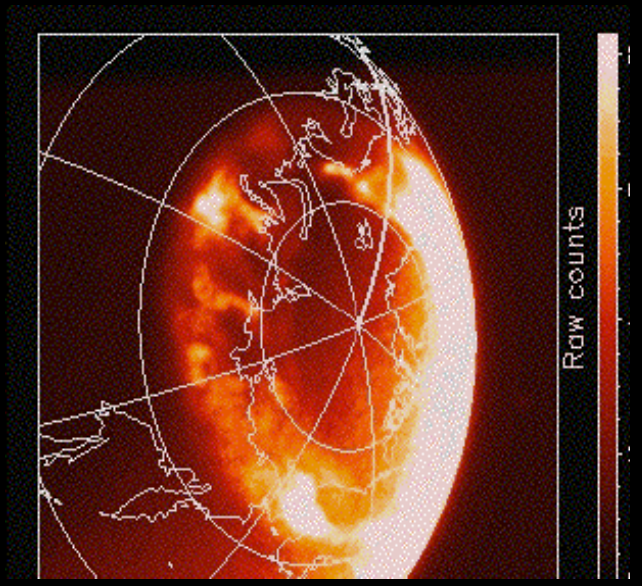
FTP service – THE model is CDAWeb ftp site (NO questions asked access)

GB During ILWS

What are the main thrusts on the world scene?

Keeping the Chair's declared COI in mind…





It has become accepted to include *global* imaging from space in ground-based working groups (Cluster GBWG).

The Chair has proposed this and engaged Jim Spann, Aaron Ridley, & Robert Rankin to write a "vision document" for global imaging (workshop likely in August – Paper to follow).

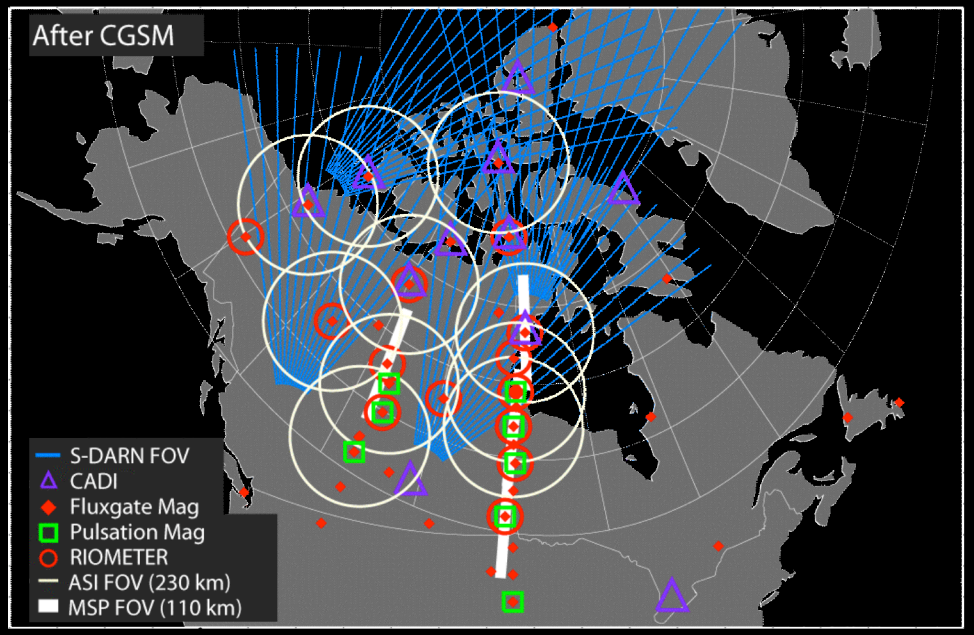
Canadian GeoSpace Monitoring

Future

40	Fluxgates
8	Induction Coils
13	Riometers
4	MSPs
10	ASIs
3-4	HF Radars
6-8	CADIs

F10.7 Solar Flux Monitor

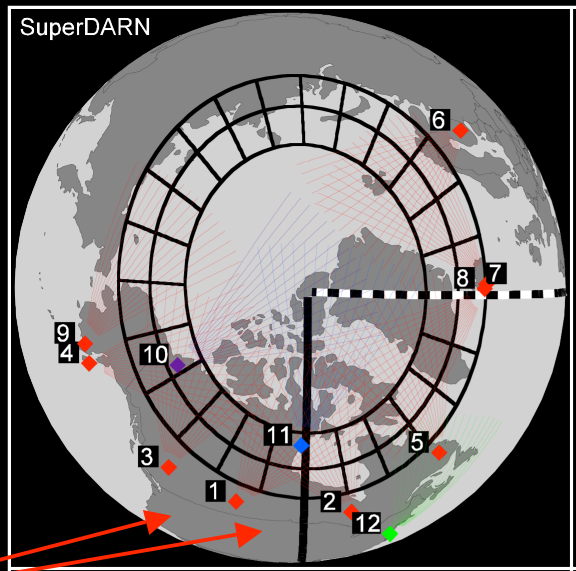
FDAM/SSDP



World Inventory

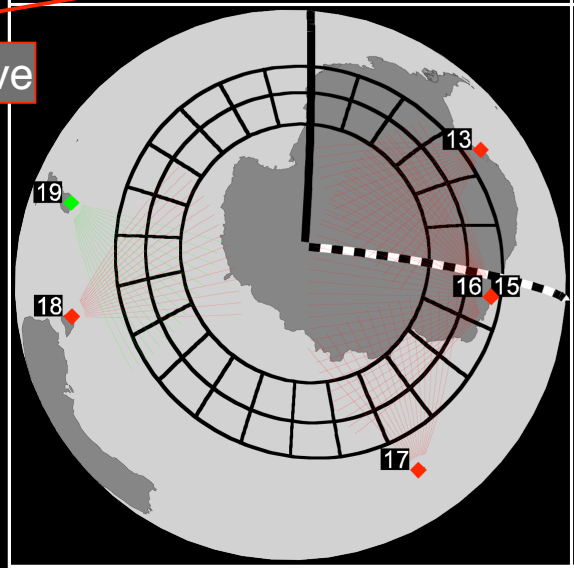
Focus on Large & Overlapping Programs

May 2004



Northern Hemisphere

1	saskatoon	Canada
2	kapuskasing	USA
3	prince george	Canada
4	kodiak	USA
5	goose bay	USA
6	hankalsalmi	UK
7	thykkvibaer	UK
8	stokkseyri	France
9	king salmon	Japan
10	inuvik	Canada
11	rankin inlet	Canada
12	Wallops	USA



Southern Hemisphere

13	Halley Station	UK
14	Sanae	South Africa
15	SYOWA South	Japan
16	SYOWA East	Japan
17	Kergeulen	France
18	TIGER	Australia
19	Unwin	Australia

- Operating
- Planned - Funded
- Planned - Proposed
- Planned

0630 UT - Magnetic Midnight
0630 UT - 0600 MLT (DAWN)

Real Growth

StormDARN Initiative

Global Coverage

Conjugate Studies

Genuine International Program

Real Community

ILWS

World Inventory

Focus on Large & Overlapping Programs

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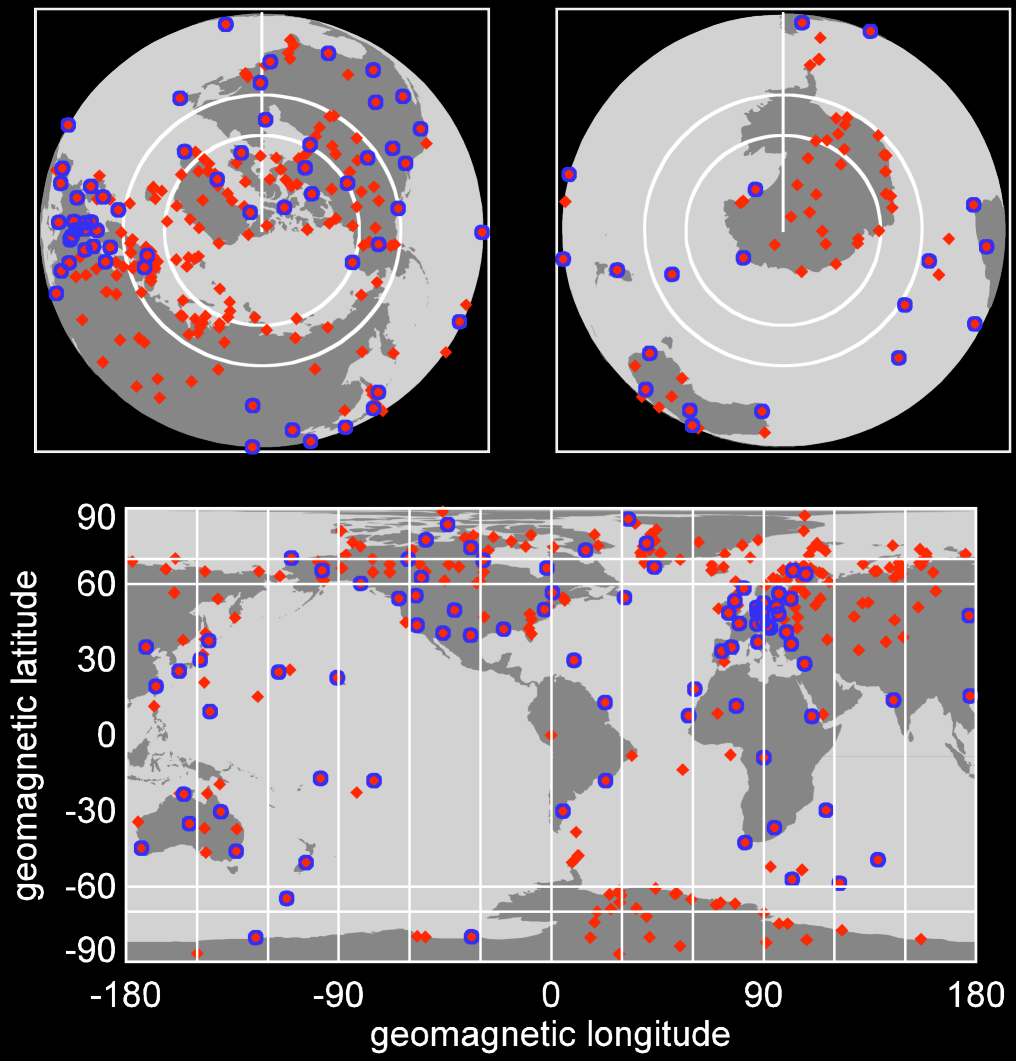
SuperMagnet?
CAWSES



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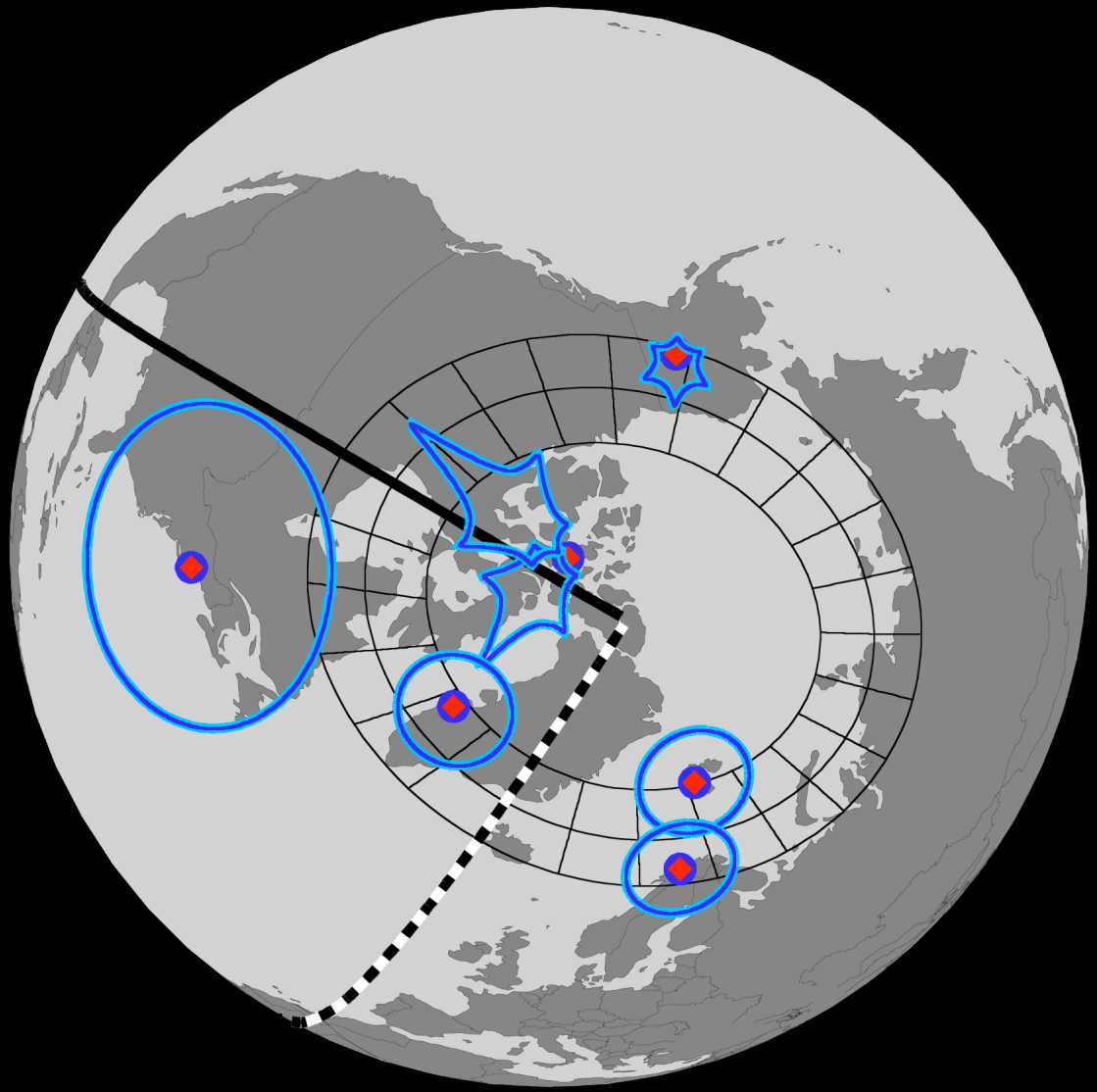
ISR



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World Inventory

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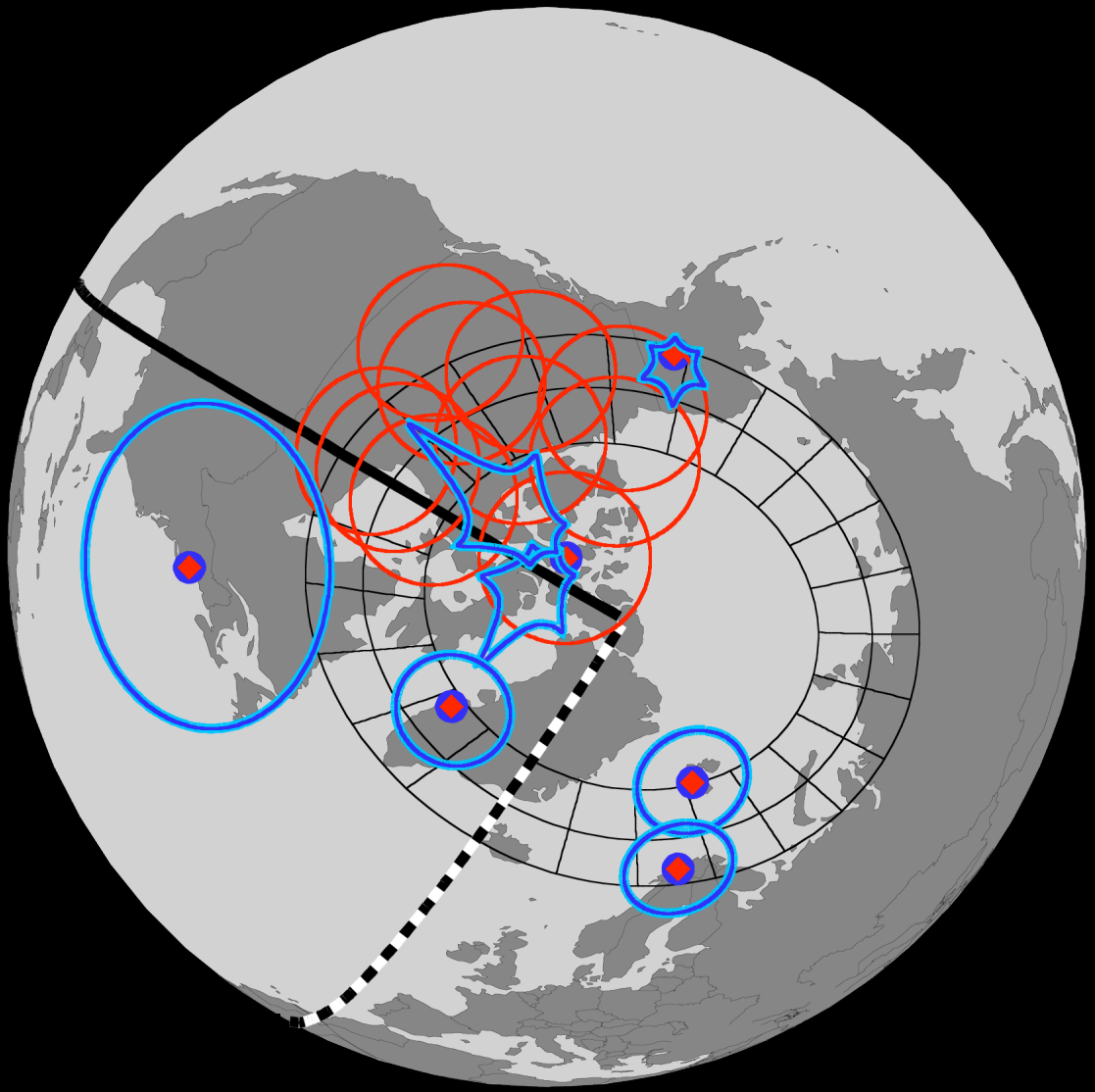
Focus on Large & Overlapping Programs



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World Inventory

Focus on Large & Overlapping Programs

SPEAR

HAARP

ARECIBO

TROMSO

SURA

SPEAR will operate as a SuperDARN like but all-sky HF radar
The high power transmitter is running and lower power capabilities
Will be available later this year.

High power RF to modify the ionospheric parameters such as e- density, temp and more (as detected by ISRs) and creates sharply field-aligned irregularities (providing “hard” targets for coherent radars).

Plasma physics via irregularities, wave-wave coupling, wave-particle interactions, etc.

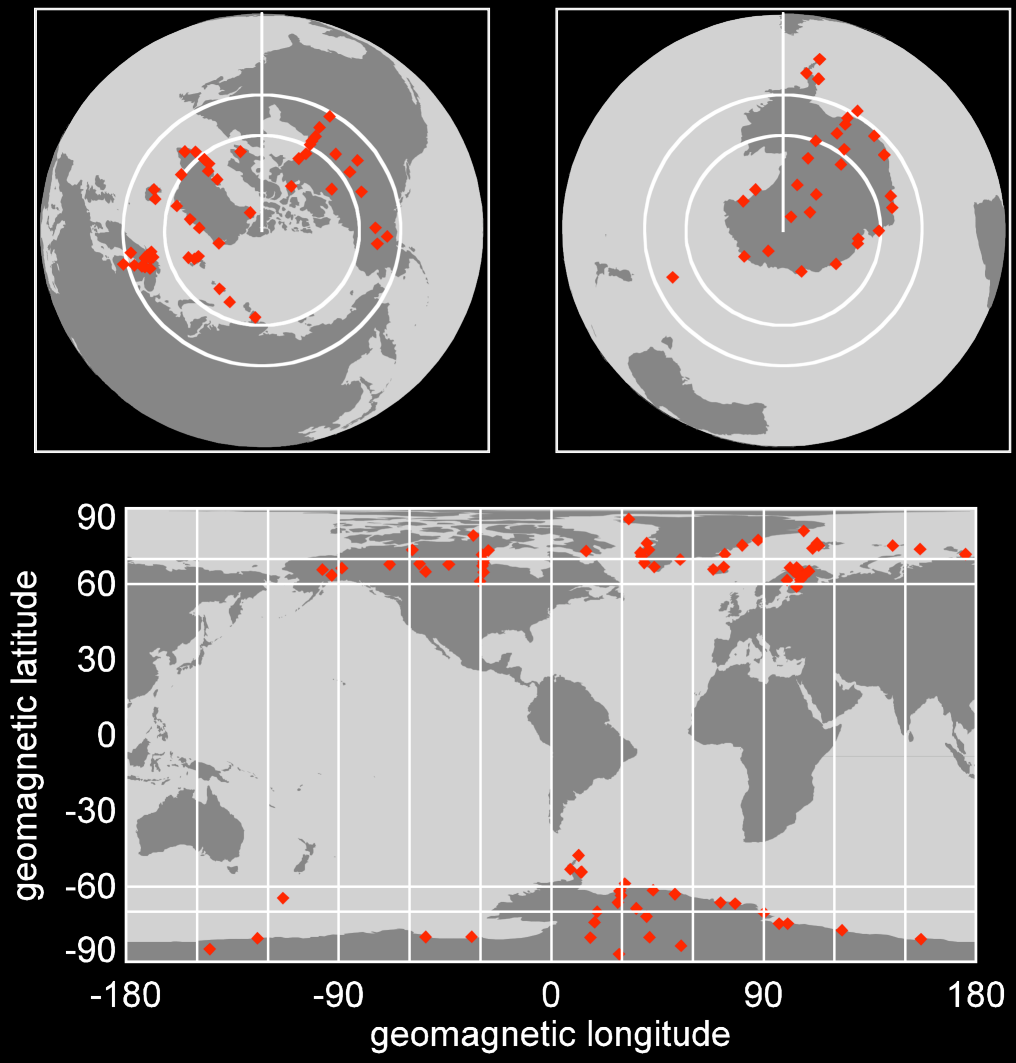
Geophysics – the hard targets allow detailed probing of irregularity dynamics as driven by MI coupling (eg., reconnection, ULF waves, etc). See eg., *Wright and Yeoman, GRL,* 1999 (ring current feeding energy into wave modes and Pedersen currents and Joule heating).

World Inventory

Focus on Large & Overlapping Programs

May 2004

GLORIA



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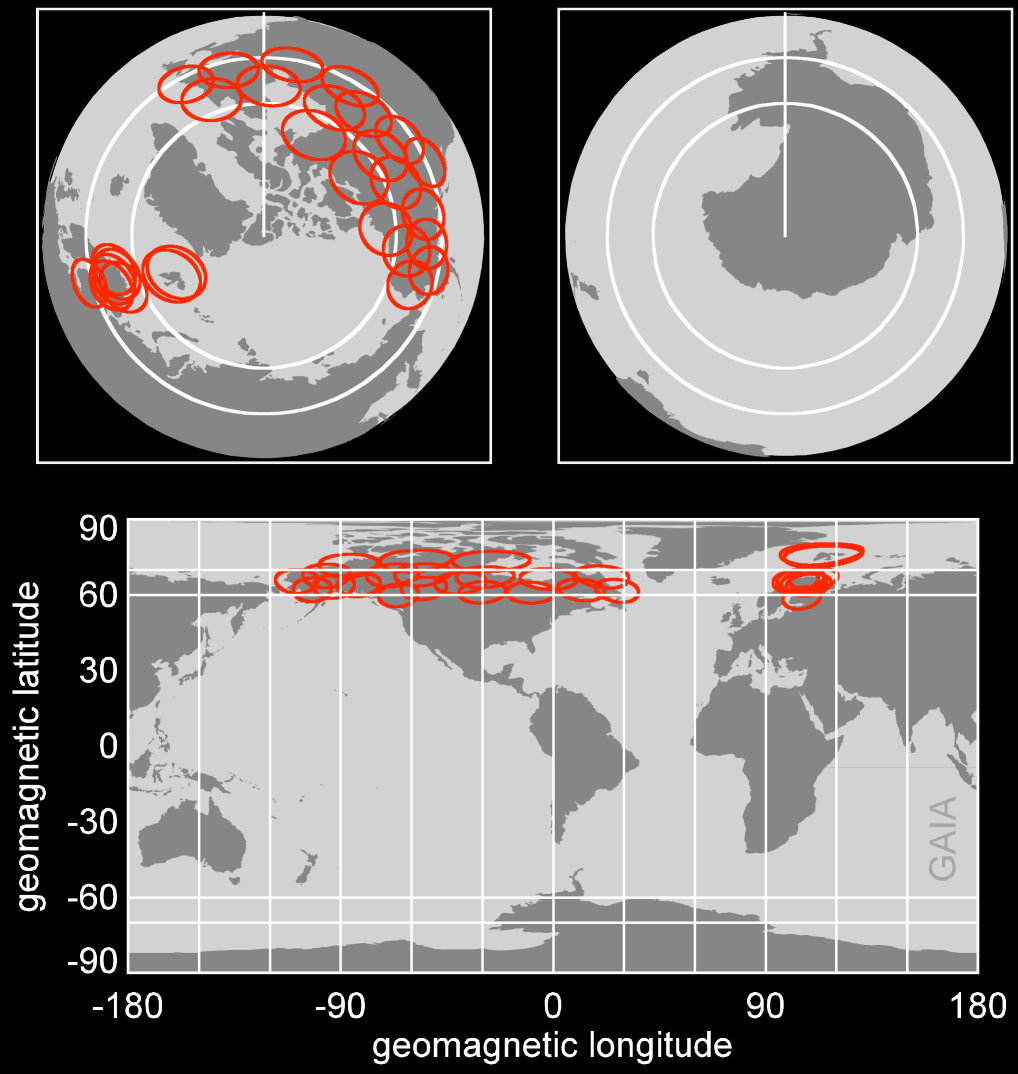
World Inventory

Focus on Large & Overlapping Programs

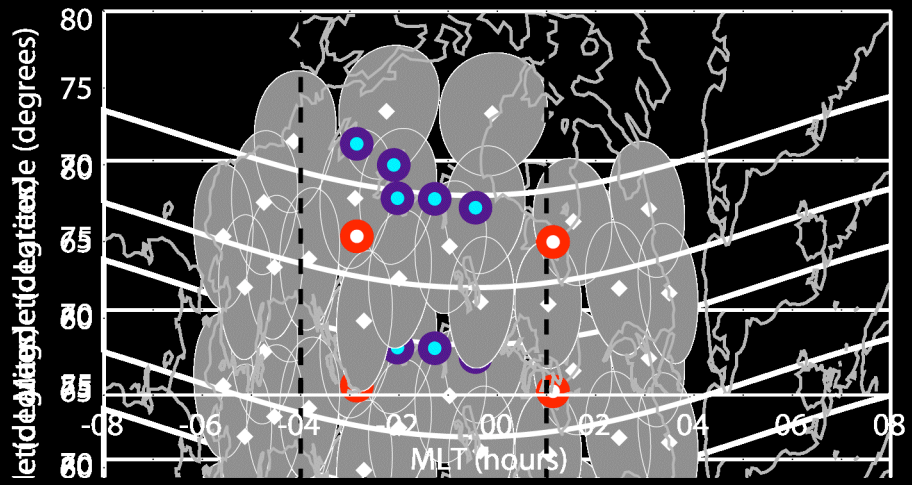
May 2004

GAIA

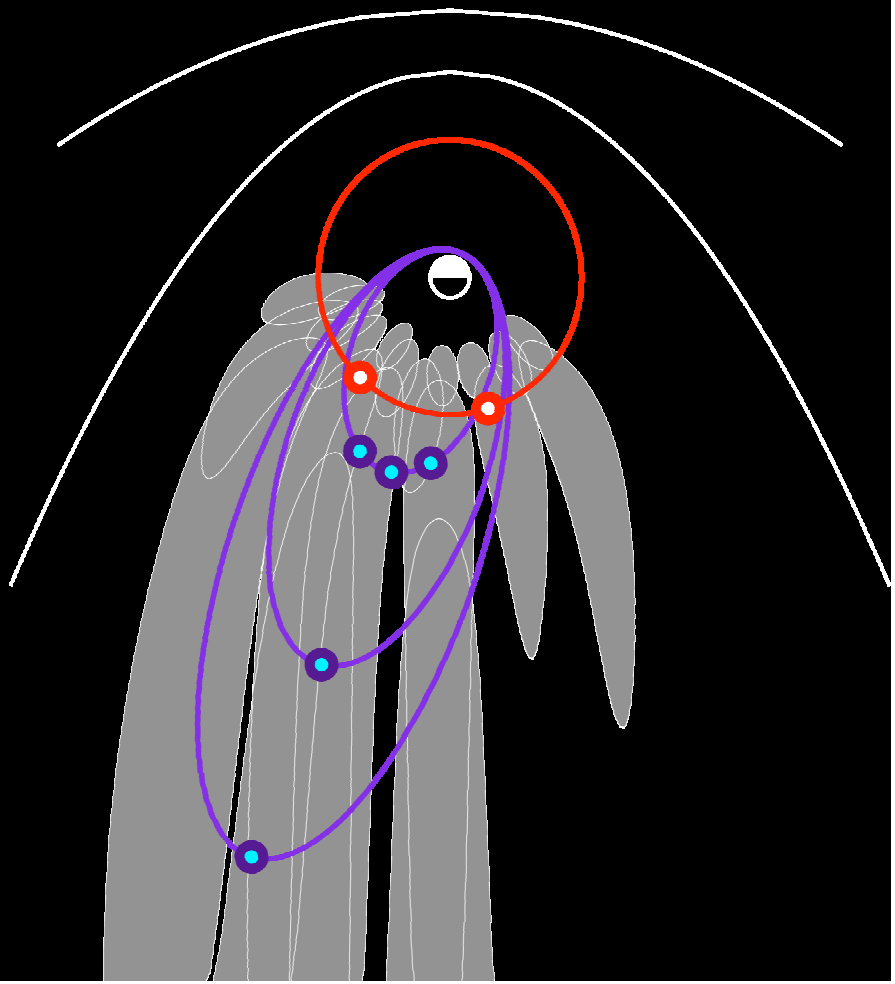


ILWS

Satellite Conjunctions



The ASI array provides a means of following CPS dynamics.



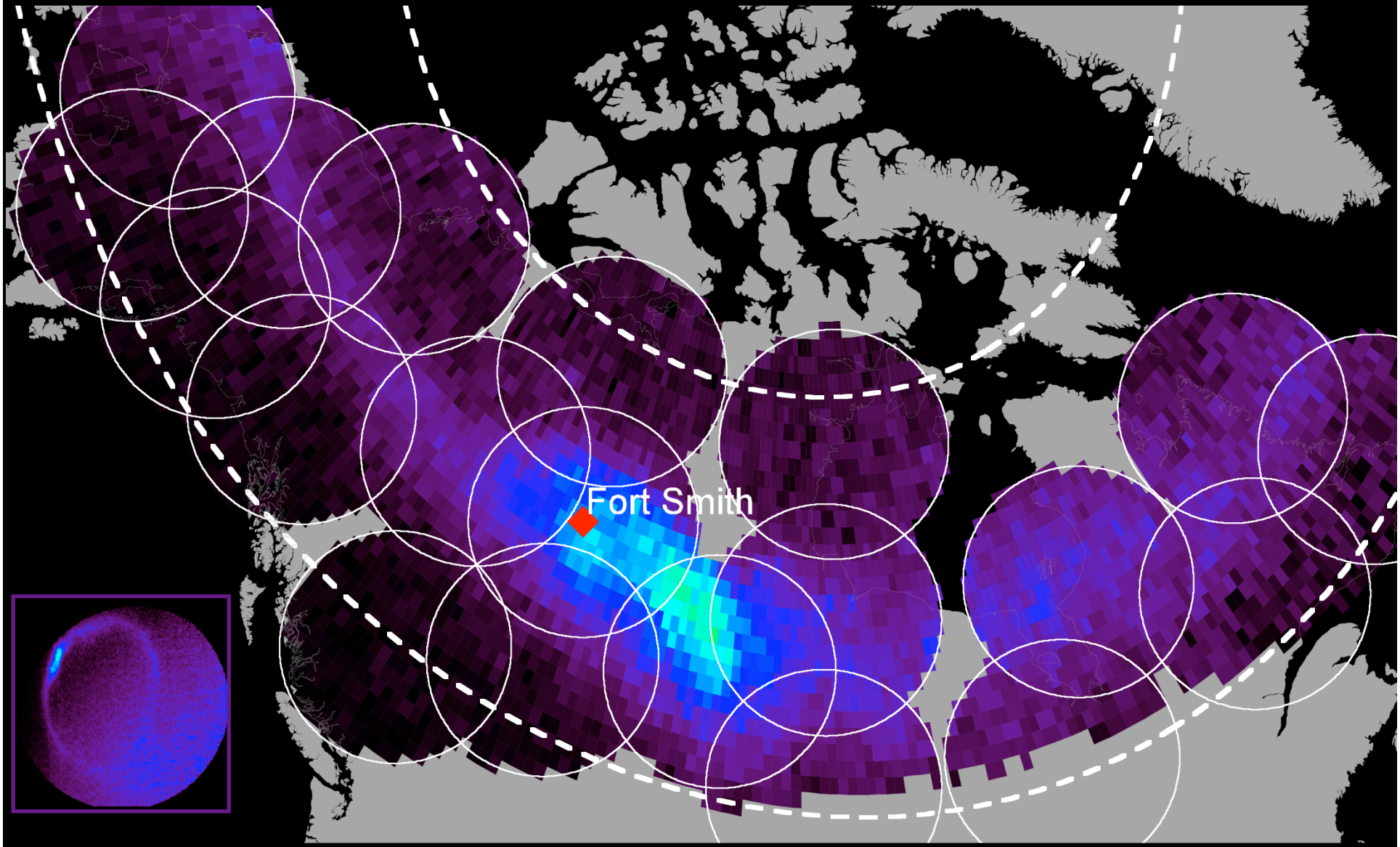
caveat

Information provided by this array is subject to our understanding of the mapping and the relationship between CPS processes and their auroral counterparts.

World Inventory

May 2004

Focus on Large & Overlapping Programs



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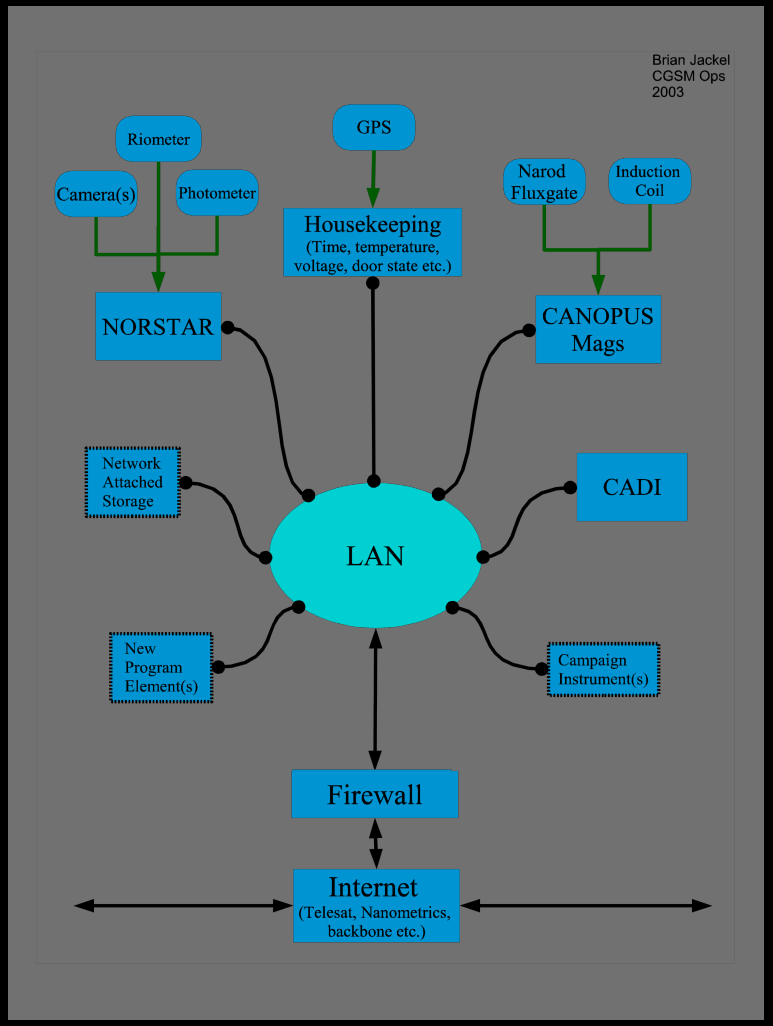
World Inventory

May 2004

"Plug and Play" Remote Geospace Stations



Data Transport Network, CGSM, DASI, etc…

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World Inventory

May 2004

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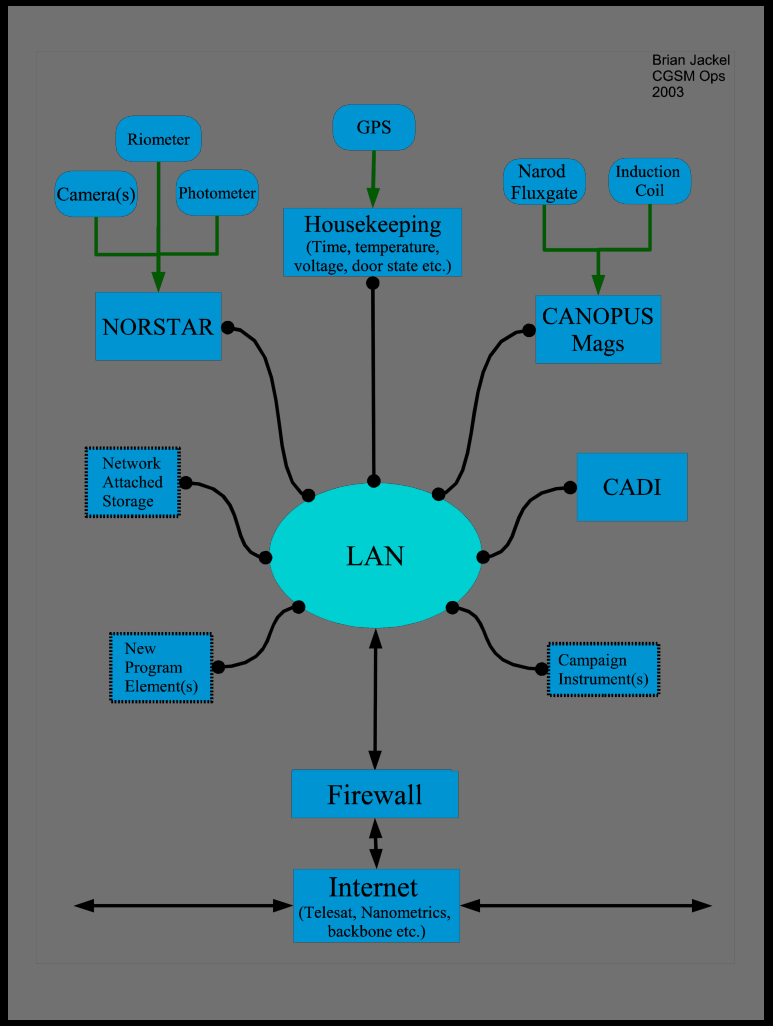

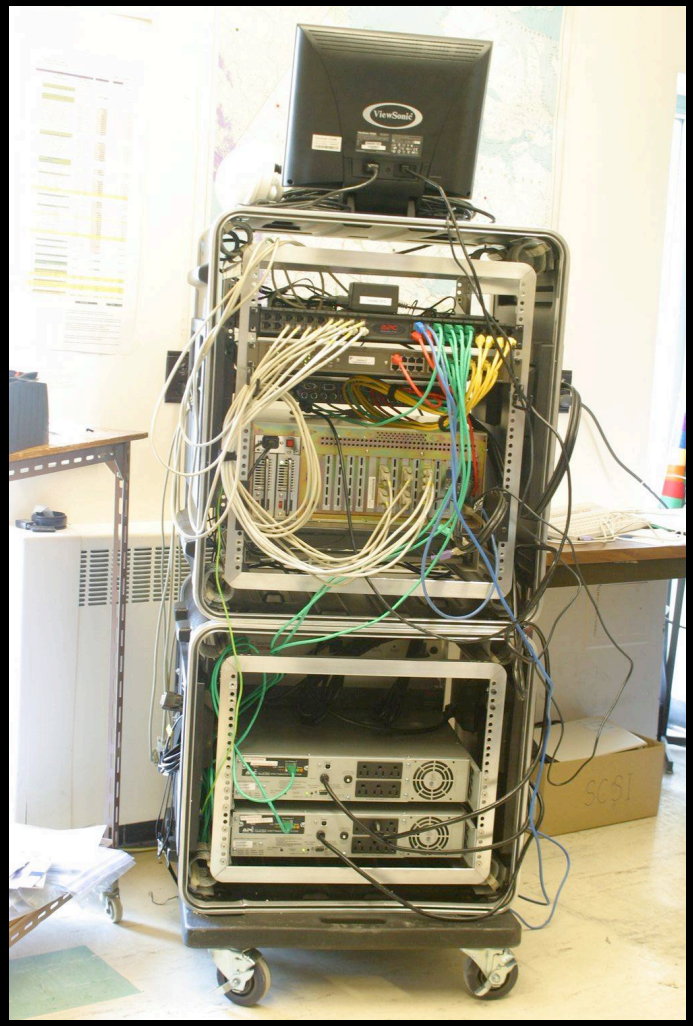

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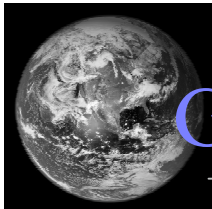

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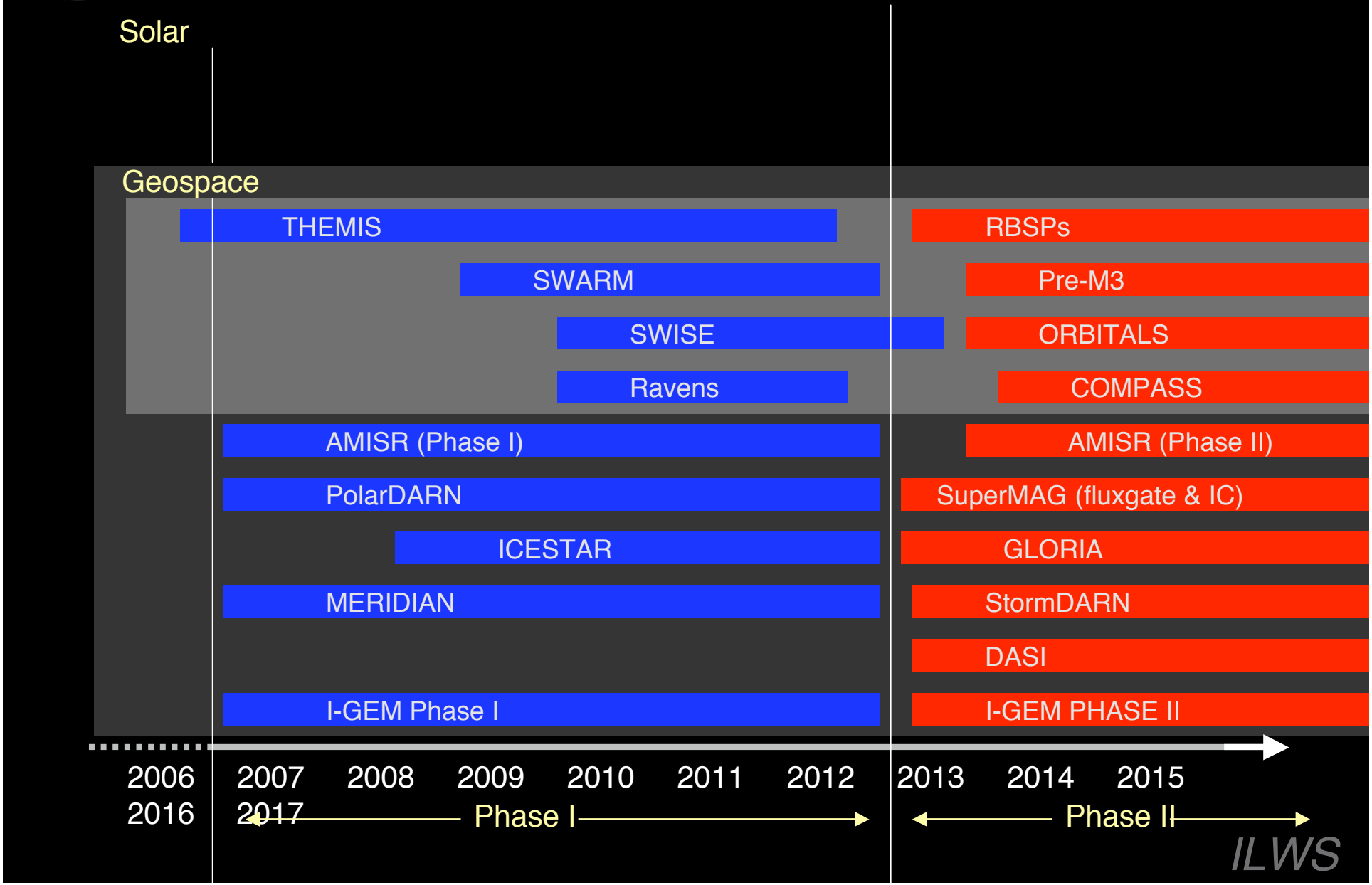
ILWS Science

Themed Phases – Truly International

May 2004



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